

We claim:

1. A flow control valve for controlling the flow of fuel in a fuel system, comprising:

a housing including a fuel passage;

a valve device movable to close said fuel passage to block fuel flow through said fuel passage, and to open said fuel passage to permit fuel flow through said fuel passage;

a valve plunger engaging said valve device, said valve plunger being adapted to reciprocally move between an extended position in which said valve device is moved to said closed position, and a retracted position in which said valve device is moved to said open position;

an actuator means for reciprocally moving said valve plunger, said actuator means including a solenoid assembly including a coil capable of being energized to move said valve plunger into said retracted position and an armature connected to said valve plunger for movement with said valve plunger toward said extended position;

an armature overtravel means for permitting continued movement of said armature relative to said valve plunger from an engaged position into a disengaged position when said valve plunger reaches said extended position, said armature overtravel means including an overtravel biasing means for returning said armature from said disengaged position to said engaged position prior to subsequent energization of said coil; and

an armature stop means for stopping overtravel of said armature.

2. The flow control valve of claim 1, further including a valve seat formed on said housing for sealing engagement by said valve device, said overtravel biasing means being positioned axially between said valve seat and said armature.

3. The flow control valve of claim 2, wherein said overtravel biasing means includes an overtravel biasing spring extending around said valve plunger.
4. The flow control valve of claim 1, further comprising an armature sleeve circumscribing around at least a portion of said valve plunger.
5. The flow control valve of claim 1, wherein said valve device includes a ball valve and a valve guide.
6. The flow control valve of claim 5, further comprising a retainer that circumscribes around at least a portion of said valve plunger and abuts said armature.
7. The flow control valve of claim 6, wherein one end of said overtravel biasing spring abuts said retainer.
8. The flow control valve of claim 7, wherein another end of said overtravel biasing spring abuts said valve guide of said valve device.
9. The flow control valve of claim 7, wherein said housing includes a recess cavity for receiving said armature, said recess cavity including an inner bottom surface.
10. The flow control valve of claim 9, wherein another end of said overtravel biasing spring abuts said inner bottom surface of said recess cavity.
11. The flow control valve of claim 6, wherein said armature stop means includes a fluid film gap that fluidically resists overtravel movement of said armature.

12. The flow control valve of claim 11, wherein said fluid film gap is positioned between said retainer and said valve guide.

13. The flow control valve of claim 11, wherein said retainer comprises an upper piece that abuts said armature, and a lower piece secured to an end of said valve plunger, said fluid film gap being positioned between said upper piece and said lower piece.

14. The flow control valve of claim 13, wherein said overtravel biasing spring is positioned between said upper piece and said lower piece of said retainer.

15. The flow control valve of claim 11, wherein resistance to overtravel movement of said armature is determined at least partially by the dimension of said fluid film gap.

16. The flow control valve of claim 1, further including at least one of a spring disk and a solenoid spacer adapted to control a stroke distance moved by said armature when said solenoid assembly is energized to retract said valve plunger.

17. A flow control valve for controlling the flow of fuel in a fuel system, comprising:

an armature housing including a fuel passage;

a valve device including a ball valve and a valve guide, said valve device being movable to close said fuel passage, and to open said fuel passage;

a valve plunger engaging said valve device, said valve plunger being adapted to reciprocally move between an extended position, and to a retracted position;

a solenoid assembly actuable to move said valve plunger into said retracted position, said solenoid assembly including an armature connected to

said valve plunger for movement with said valve plunger toward said extended position, said armature further being adapted to disengage from said valve plunger and to overtravel relative to said valve plunger;

a retainer that circumscribes around at least a portion of said valve plunger and abuts said armature;

an overtravel biasing spring extending around said valve plunger and being adapted to return said armature from said disengaged position to said engaged position; and

a fluid film gap that fluidically resists overtravel movement of said armature.

18. The flow control valve of claim 17, wherein said housing includes a recess cavity with an inner bottom surface, ends of said overtravel biasing spring abutting said inner bottom surface and said retainer to exert a return force on said armature, said fluid film gap being positioned between said retainer and said valve guide.

19. The flow control valve of claim 17, wherein ends of said overtravel biasing spring abut said retainer and said valve guide to exert a return force on said armature, said fluid film gap being positioned between said retainer and said valve guide.

20. The flow control valve of claim 17, wherein said retainer comprises an upper piece that abuts said armature, and a lower piece secured to an end of said valve plunger, ends of said overtravel biasing spring abutting said upper piece and said lower piece of said retainer, and said fluid film gap being positioned between said upper piece and said lower piece.